Harnser

Mathematics Calculations Policy

The aim of this policy is to ensure consistency of mathematics methods and teaching throughout the school. It gives an overview of the strategies used in our school to teach to the year group objectives in the 2014 Primary Mathematics Curriculum.

Children should be able to problem solve effectively and select an efficient method of their choice that is appropriate to the task. This includes practical, mental and formal written methods. They are encouraged to decide upon the best way to try and solve a problem then use the appropriate method to do so.

Overall aims by the end of KS2:

- Have a secure understanding and knowledge of number facts and be able to select and use any of the four operations appropriately.

- Use their knowledge to carry out calculation mentally and to apply appropriate strategies when calculating with multi-digit numbers.

- Make use of diagrams, informal notes and jottings to record their thought processes when there is more information than can be kept in their heads.
- (Fluency, reasoning and problem solving)

Appendix: Maths vocabulary for the new curriculum

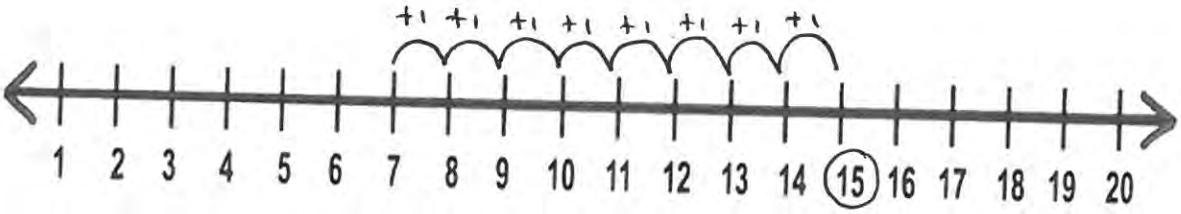
Addition

Reception

Addition will be taught using practical handling and manipulation of objects and equipment. This will focus on altogether and then counting on amounts. They will progress to recording on a labelled number line by the end of the year.

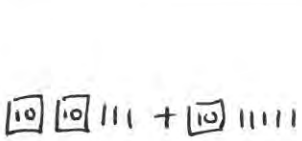
Year 1

Children will continue to use practical equipment and labelled number lines to assist their counting on. (draw labelled number line 7+8=15)



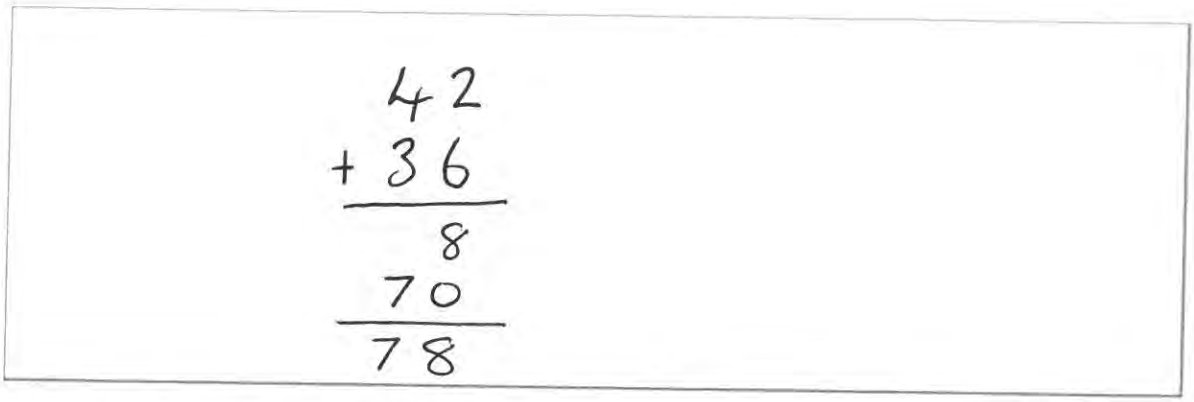
Year2

At the beginning of Year two children will move from using a number line to partitioning 2 digit numbers using Base ten as a supporting resource to visually represent the calculations. (draw 23+15 = 38) Children will be taught to add from the lowest place value point. (3+5)



23+15 =38
3+ 5 = 8
20+10 =30
30+8=38

By the end of year 2 the children should have been introduced to expanded column addition (2 digits whole numbers?). Again adding from the lowest place value first (right). Base ten should be used to display the method visually and ensure the children's conceptual understanding.

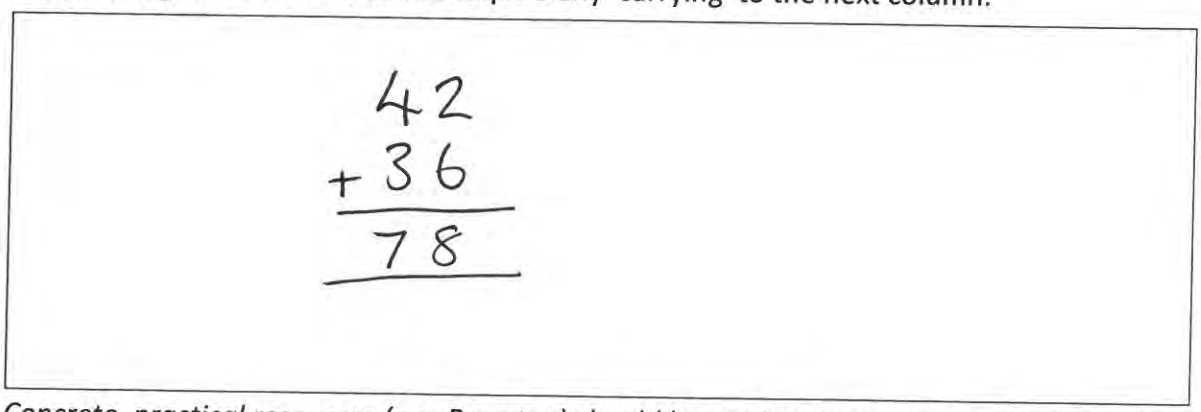


The number line in Year 3 should be used only to facilitate conceptual understanding of addition and to demonstrate the process of adding mentally.

Also, understanding of place value of digits and partitioning of 2 or 3 digit numbers are crucial early concepts to be reinforced.

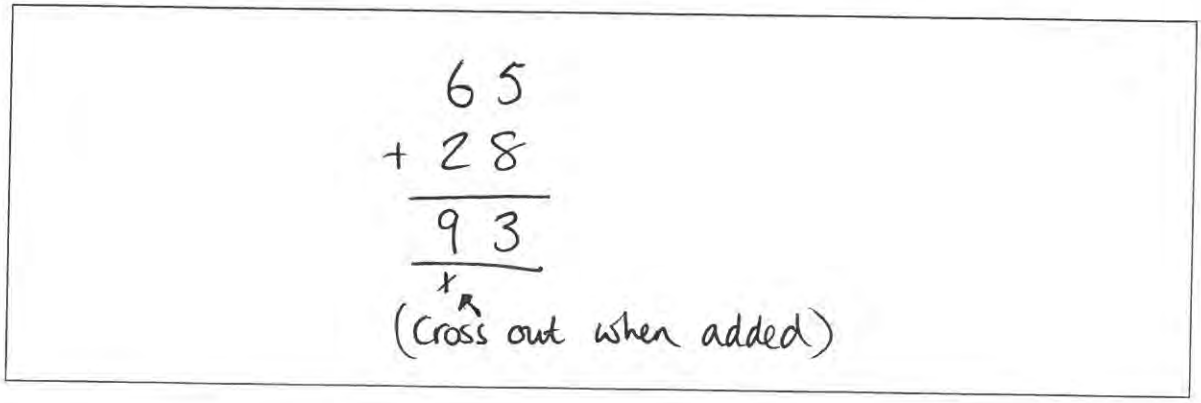
Column addition method

Method used from Year 3 to Year 6. This is introduced in Year 3 when a secure understanding of digit place value has been established. Initially in Year 3 it should be taught using numbers that do not require any 'carrying' to the next column.



Concrete, practical resources (e.g. Base ten) should be used to display the method visually and ensure the children's conceptual understanding.

Year 3/4 Once children are secure with this initial concept, they can begin to be taught calculations which involve the sum of two digits being larger than nine using the method of 'carrying' to the next place value column.



This method can then be used for the addition of multiple large numbers:

The concept of ten units becoming one ten in the next column or ten hundred becoming one thousand should again be introduced visually using concrete, physical resources.

In **Years 5 and 6** the same method can be used to solve more complicated additions:

To add multiple numbers:

789 + 642 becomes

$$\begin{array}{r} 7\ 8\ 9 \\ +\ 6\ 4\ 2 \\ \hline 1\ 4\ 3\ 1 \\ \hline \end{array}$$

(cross out to show they have been added)

Or for decimal numbers:

£7·89 + £6·42.

$$\begin{array}{r} 7{\cdot}89 \\ +\ 6{\cdot}42 \\ \hline 1\ 4{\cdot}3\ 1 \\ \hline \end{array}$$

It is essential at all times that children understand the VALUE of all digits in the calculation, and how the method works.

They are simply adding each place value column in turn. The children should be able to clearly explain their working.

Subtraction

Reception

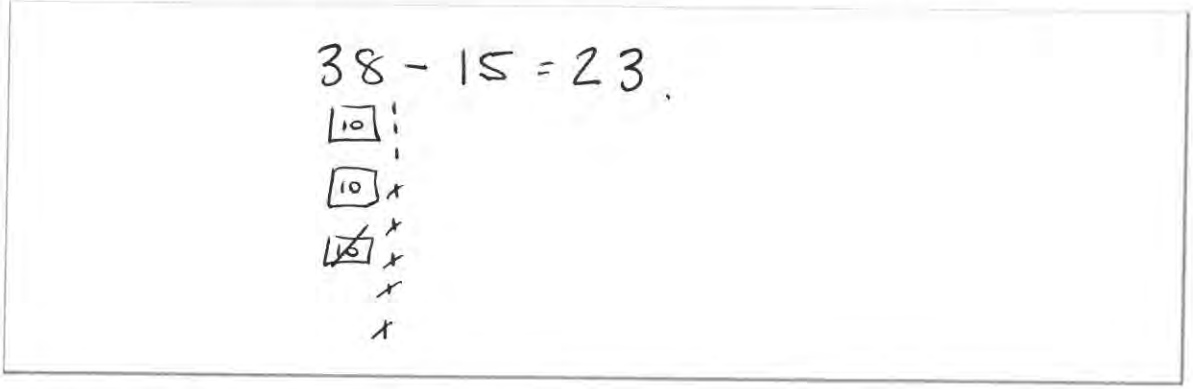
Subtraction will be taught using practical handling and manipulation of objects and equipment. This will focus on how many left and then counting back amounts.

Year 1

Children will use labelled number lines to count back.

Year 2

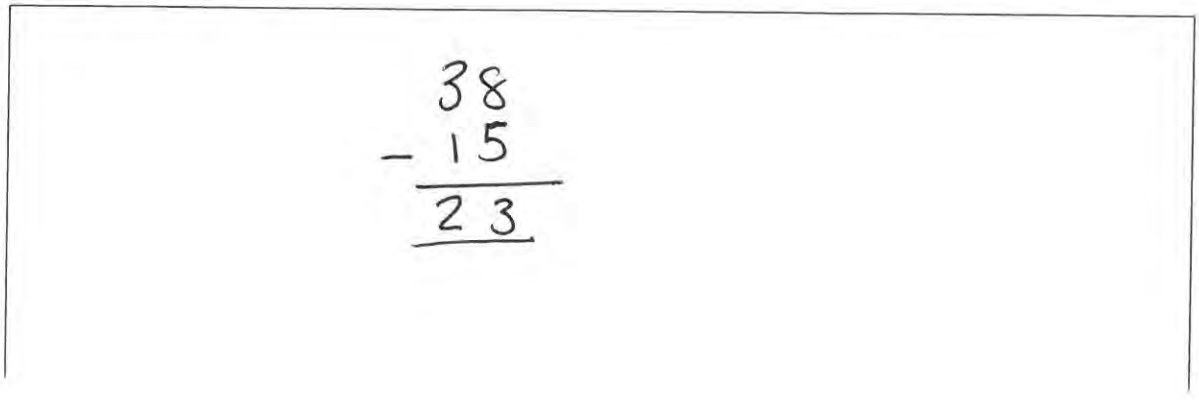
Children will use partitioning of 2 digit numbers. They will partition the larger number and use Base ten to display the method visually and ensure the children's conceptual understanding. This will not involve 'exchanging' initially, but by the end of the year exchanging should have been introduced and visually modelled using Base ten.



The number line, or 'counting on', method should only be used in Year 3 to facilitate a conceptual understanding of 'finding the difference' between two numbers and to enhance mental subtraction calculations. Counting up to find the difference could be taught and used when most appropriate and efficient (e.g finding change to whole values of money like £1.00 or subtracting from multiples of 100 etc)

Column Subtraction

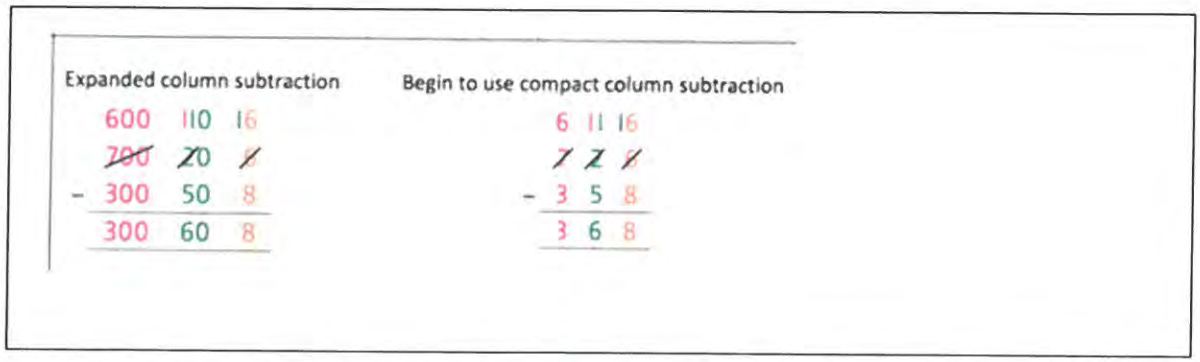
Method used from Year 3 to Year 6. This is introduced in Year 3 when a secure understanding of digit place value has been established. Initially in Year 3 it should be taught using numbers with a higher digit in each place value column to introduce the method simply.



Concrete resources can be used to clearly demonstrate what is being represented by the calculation. ***It is important for the children to understand and articulate that the 6 – 3 = 3 is actually 60 – 30 = 30. Their understanding of digit value is crucial.***

Decomposition

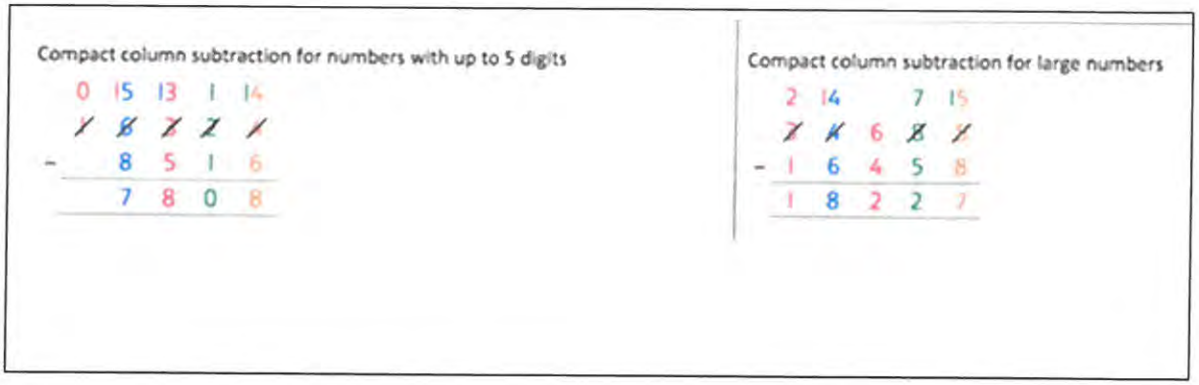
Once secure, children are then introduced to the concept of 'decomposition' whereby numbers can be 'exchanged' across place value columns.



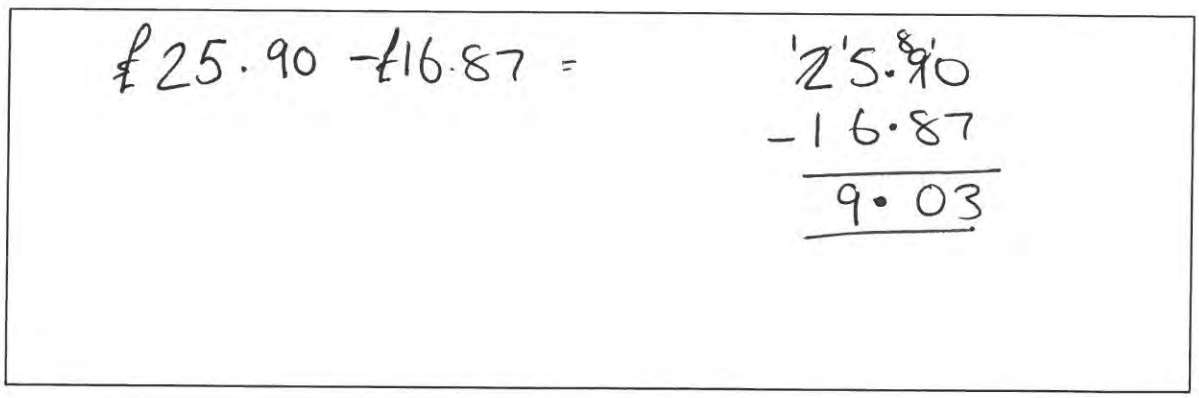
In the above example, it is important they understand one 'ten' has been *exchanged* for ten 'units' because they have the same value. *Concrete resources should be used to demonstrate to children what has happened and WHY the method works.*

Year 5 and 6

The method is widened to include larger numbers:



And also decimals:



Multiplication

Reception

Children will be introduced to the concept of doubling using practical handling of objects.

Year 1

Children will be supported to develop an understanding of concrete objects and pictures as arrays and repeated addition.

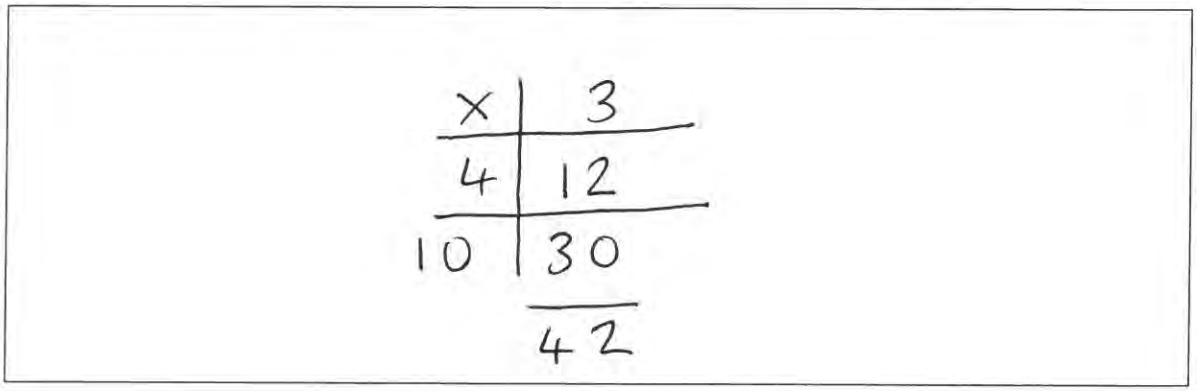
A secure understanding of times table facts is the basis for all multiplication methods used and therefore an essential requirement.

Year 2

Children will continue to consolidate their understanding gained in Year 1 through individual practice.

Year 3

Children use their knowledge of time table facts and place value to carry out simple multiplications using commutative properties (partitioning numbers). 14 x 3=



Arrays and physical resource should be used in Year 3 to demonstrate visually the process of multiplication and to link it conceptually to repeated addition.

Year 4

Children begin to multiply 2 digit numbers by a 1 digit number using short multiplication.

24 × 6 becomes

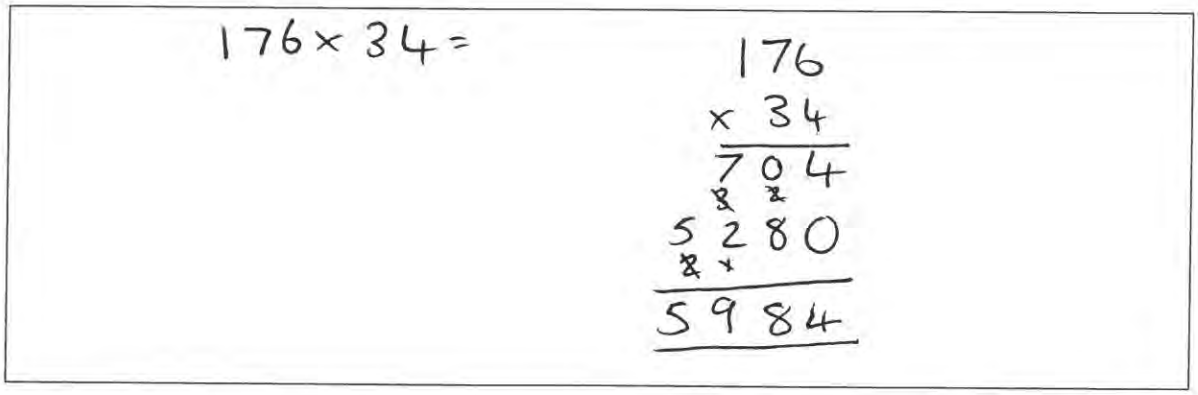
$$\begin{array}{r} 2\ 4 \\ \times\quad 6 \\ \hline 1\ 4\ 4 \\ \hline \end{array}$$

Answer: 144

Children should understand why the small digit is placed in the next column: it represents 20 so has been placed in the tens column and added to the other tens in that column.

Year 5

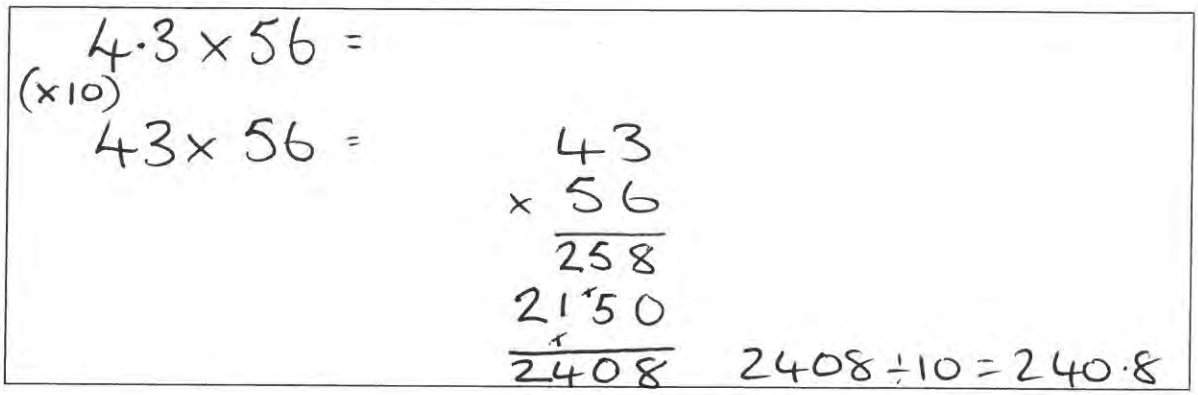
Children move on to multiplying 3 and 4 digit numbers by a 2 digit number using column (long) multiplication. (cross out carried numbers to avoid confusion when adding answers)



Children should understand that it is 176 x 4 and 176 x 30. The 3 is worth 30 therefore the answer will be ten times bigger so a zero is put into the units column as a placeholder. Principles of column addition apply when calculating a final answer.

Year 6

Understanding of place value and multiplying/dividing by 10, 100, 1000 is used to calculate multiplications involving decimals.



'Multiplying out' the decimal in the question (x 10 to make 43 x 56) then dividing answer by 10 to put the decimal back in.

Division

Reception.

Children will be introduced to the concept of division as halving using concrete objects and drawings.

Year 1

Children will develop their understanding of division as the inverse of multiplication and as 'sharing' using practical physical activities to develop conceptual understanding.

Year 2

Division will be represented as an array as in multiplication.

Year 3

In Year 3 children may use number lines or physical resources to represent grouping and sharing to ensure their conceptual understanding of what division actually means. In this way they can be introduced to the concept of remainders:

22 coins are shared between 4 people: Four groups of five with two left over.

Short Division (Bus Stop)

Once there conceptual understanding of what division actually means has developed, this method is introduced from Year 3 up to Year 6.

98 ÷ 7 becomes

$$\begin{array}{r} 1\ 4 \\ 7\overline{)\,9^{2}\ 8} \end{array}$$

Answer: 14

432 ÷ 5 becomes

$$\begin{array}{r} 8\ 6\ \text{r}\,2 \\ 5\overline{)\,4\ 3^{3}\ 2} \end{array}$$

Answer: 86 remainder 2

As children progress, they should be able to interpret remainders as fractions or as a decimal.

496 ÷ 11 becomes

$$\begin{array}{r|l} & 4\ \ 5\ \ r1 \\ \hline 1\ 1 & 4\ \ 9\ \ {}^{5}6 \end{array}$$

Answer: $45\frac{1}{11}$

In Year 6, children will need to be able to divide by a 2 digit number.

Jotting down tables, estimates and multiplications in a right hand column are all techniques that can be used to assist in dividing by larger numbers in circumstances where the children do not know the times table.

$432 \div 15 =$

$$\begin{array}{r|l} & 2\ \ 8\ \ r12 \\ \hline 15 & 4\ {}^{4}3\ {}^{13}2 \end{array}$$

Jottings.

$$\begin{array}{r} 15 \\ \times\ 8 \\ \hline 120 \\ {}_{4} \end{array}$$

If children are very secure in using multiplication facts and being able to adapt their knowledge, then they can extend this strategy to increase efficiency.

$498 \div 6 =$

1 x 6 = 6	10 x 6 = 60
2 x 6 = 12	20 x 6 = 120
3 x 6 = 18	30 x 6 = 180
4 x 6 = 24	40 x 6 = 240
5 x 6 = 30	50 x 6 = 300
6 x 6 = 36	60 x 6 = 360
7 x 6 = 42	70 x 6 = 420
8 x 6 = 48	80 x 6 = 480

498 is 83 x 6.